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SPECIFICATIONS FOR BUILDING THE SEA WALL ALONG THE WATER FRONT OF SAN FRANCISCO.

GENERAL DESCRIPTION.

A pit, or channel, sixty feet wide, at the bottom, at a level of twenty feet below mean low tide, is excavated, and in this channel is placed the foundation of the sea wall, consisting of a rock embankment, thirteen feet in width on top at the level of mean low tide. The outer extremity of the excavation corresponds with the city front, and consequently, at this point the slope of the rock embankment is twenty feet below mean low water. The stones are thrown *pellmell* into the Bay, beginning on the center line of the embankment, and are allowed to settle until they reach a firm foundation.

When it is ascertained that the settling has ceased, a body of concrete, two feet in thickness and ten feet in width, is laid upon the embankment, and upon this concrete is constructed a wall of solid masonry.

This wall is seven feet and three inches in width at the bottom, and nine feet eight inches in height. It is vertical on the land side, and on the harbor side has a batter of two inches to the foot

for seven feet and eight inches, where there is an offset of two feet, forming a recess designed to receive the ends of the timbers of the wharf. From this offset the wall is carried up vertically two feet, making it four feet in width on the top.

The top of the wall is four inches below the official grade of the city, and the face of the wall at the top is forty feet distant from the line of the water front.

A sewer is designed to pass through the middle of every street intersected by the sea wall. Through the wall a brick sewer with granite facings must be constructed, and through the earth embankment, from the termination of the brick sewer to its outer slope, a timber sewer. The form and dimensions of the sewers will correspond with those used by the city in the respective streets.

The face of the embankment on the harbor side is protected by a *rip-rap* wall, no stone in which shall weigh less than five hundred pounds.

The back of the sea wall is forty-four feet distant from the line of the water front, leaving thirty-one feet to the middle of the street. This space back of the wall is to be filled in with earth embankment, the inner side having a slope of one and a half horizontal to one vertical.

REMOVAL OF OBSTRUCTIONS.

All wharves, piles, or other obstructions within the limits of the proposed work, must be removed by the contractor, and all plank, squared timber, or other valuable material found within said limits, shall be deposited by him in such place as shall be designated by the Engineer, which place shall be as convenient to the work as practicable.

DREDGING.

The dredging must extend to a depth of twenty feet below mean low tide, or thirty-two feet below the official grade of the street. The bottom of the excavation is sixty feet in width, the outer extremity of the base corresponding with the city front; and the slopes must be such as shall be necessary for the adjacent earth to

retain its position until the rock embankment is deposited, and any filling up prior thereto must be dredged out, and the channel kept clear to the depth required.

The dredging must not be carried more than one hundred feet in advance of the rock embankment, and any broken piles or other deposits found within the limits of the space to be dredged must be removed by the contractor, so that at the bottom of the excavation there shall be a homogeneous material. The earth taken from the excavation must not be deposited nearer to the water front than one thousand yards.

ROCK EMBANKMENT.

The top of the rock embankment will, at first, be at an elevation of seven feet above mean low tide, or five feet below the official grade, and will be seventeen feet in width. At a depth of twenty feet below mean low tide, the rock will occupy the full width of sixty feet excavated by dredging. The rock first deposited will sink below the bottom of the pit excavated by dredging, and after it has been filled in to that level, the embankment will be carried up to the top on a slope of one to one on the harbor side, and on a slope of six-tenths to one on the city side. Should the rock be deposited by boats or scows, the central part must first be filled in.

In the formation of the rock embankment no earth shall be used, nor any stone subject to decomposition by exposure to air or water. Uniformity of size is not demanded; stone as generally quarried and readily handled answering all requirements.

The larger stone shall be deposited on the outer or sea slope of the embankment. The sea slope, from the bottom up to nine feet below low water mark, for a width of four feet, shall contain no stone of less weight than twenty pounds; and from said nine feet to the upper surface, no stone less than one hundred pounds in weight.

The rock embankment shall be allowed to settle until, in the opinion of the Engineer, it shall have reached a permanent foundation. The time required for settling depends upon the character of the earth below the rock, but under any circumstances must be several months.

EARTH EMBANKMENT.

After the rock embankment has been made, the earth embankment in the rear may be filled in to the same level. The top of the earth embankment, when completed, will be on a level with the official grade of the street, and extends thirty-one feet from the back of the sea wall, or to a line seventy-five feet distant from the City Front. The embankment on the inner side has a slope of one and a half horizontal to one vertical.

THE CONCRETE FOUNDATION.

The concrete foundation, ten feet in width and two feet in depth, as shown in the drawings, must next be built.

The concrete shall be made from clean broken stone, sharp clean sand, and either Benicia or Rosendale cement. Benicia cement is preferred on account of setting more speedily. The cement must be fresh ground, and every lot must be approved by the Engineer before using.

The stone shall be broken so as to pass through a ring three inches in diameter. The cement mortar, composed of two parts of cement to three parts of sand, shall first be thoroughly mixed, and then carefully mixed with the broken stone in the proportion of one of mortar to two of stone, or in such other proportions as the Engineer, upon experiment, shall determine. It shall be carefully laid and well rammed, and shall be protected on the sides by planking, which shall not be removed until the concrete has thoroughly set.

THE WALL.

The wall shall be of the form and dimensions shown in the accompanying drawings, and shall be of the best quality of first class masonry. It shall be built in regular courses of the following thickness, beginning at the bottom, namely : twenty, nineteen, nineteen, eighteen and sixteen inches, to the offset of two feet, above which there are two courses of twelve inches each, making in all, nine feet and eight inches in height.

The front shall consist of Folsom or State Capitol Granite, shall be laid with alternate stretchers and headers, and each course shall

break joint with the course below it. No header shall be less than five feet in length. The stretchers in the three lower courses shall be not less than two feet, and in the remaining courses, not less than eighteen inches in width.

The masonry must have hammer-dressed beds and joints, and the vertical joints must be dressed back twelve inches from the face, with a bevel of one inch to secure the stone from displacement by the action of the waves. The mortar joints on the face not to exceed one-fourth of an inch in thickness; the face of the wall not to be hammer-dressed, but to present a rock face, except along the joints, which shall be dressed with a draft on each stone of three-fourths of an inch in width.

The stone must be dressed before laying, and must not be moved after being placed in the wall.

The bench of two feet in width, and the top of the wall, must be hammer-dressed to an uniform surface: the upper course or coping shall be of Granite for the whole width of four feet, and the stone must be so placed as to show on the top of the wall no joint more than one-fourth of an inch in width.

The rear of the wall may be constructed of other first class stone, to be approved by the Engineer and Board of Harbor Commissioners. The stone must be laid on horizontal beds, and the front and back of the wall carried up simultaneously; be well bonded together, and every course must be thoroughly grouted. The whole masonry must be laid in the best quality of hydraulic mortar, composed of three parts of sand to two parts of Benicia cement, or cement of first quality, to be approved by the Engineer, and all the joints on the face must be pointed with a cement of proper consistency.

THE PROTECTION WALL.

The action of the waves will form the face of the rock embankment approximately, as represented in the drawings. If the embankment should be washed away to a steeper inclination, it must be replaced before building the protection wall. If it shall not have settled or washed away down to the line represented, the surplus material must be removed.

As soon as any portion of the granite wall is built, the corresponding portion of the protection or *rip-rap* wall in front of it must

be constructed in the form represented in the accompanying drawings. The wall will be three feet in average thickness; the upper surface will have an inclination of one vertical to three horizontal, and must, at its lower end, be at least seven feet below mean low tide. At its junction with the granite wall, the upper surface must be at least four feet above mean low tide.

It shall be constructed of hard rock, not liable to be broken or decomposed by the action of the waves, to be approved by the Engineer and Harbor Commissioners, and no stone shall weigh less than five hundred pounds.

The stones shall be lowered to their proper position by means of derricks, their ends facing the prevalent waves, and shall be well wedged together.

SEWERS.

Sewers three feet wide and five feet high in the clear, of the egg-shape form used by the city, will be constructed through the wall at the intersection of the middle of each street. Where the contour of the sewer intersects the face of the wall, there shall be built a suitable arch of granite stones, to conform to the shape of the sewer, and the joints of the arch shall be radial to the curvature of the sewer. The ring-stones (or arch-stones) to extend back from the wall eighteen inches and thirty-six inches alternately. The outside of the ring to be cut to horizontal and vertical joints, and the adjoining masonry must be well bonded to the arch-stones, and present, when finished, a regular and artistic appearance. The masonry of the interior of the sewer will be laid with well burned brick and hydraulic mortar, and shall conform in all respects to the manner of building sewers adopted by the city authorities. When the brick work of the sewer is completed, it must be covered on top with a coating of cement mortar at least two inches in thickness.

From the inside of the wall or termination of the brick sewer, a timber sewer of a rectangular form, three feet wide and five feet high in the clear, shall be constructed, extending to the outer slope of the earth embankment, or forty-six feet from the back of the wall. The timber used in the construction shall be of the best redwood, and of the dimensions required by the city authorities in the construction of similar sewers.

ADDITIONAL SPECIFICATIONS FOR SECTIONS ADVERTISED FOR CONTRACT MAY 31, 1867.

The length of the section stated in the advertisement is the exact length of the wall of masonry designed to be constructed in that locality.

To give stability to the foundation, the rock embankment must extend beyond the end of the wall, and the dredged channel must be continued to the full width and depth thirty-five feet beyond the wall.

The rock embankment will then be filled in, at first to the same height as the adjoining embankment, (one foot above high tide) the foot of the slope extending to the termination of the bottom of the dredging, and the top being nine feet from the end of the wall.

The embankment will be allowed to settle, and, if necessary, heavy stone will be placed upon it to protect it from being washed away before the adjacent section is constructed.

A deposit of stone four feet in thickness must also be placed along the slope of the earth embankment at its termination, to prevent its displacement by the water. These requirements apply to the termini of all the walls in the sections proposed to be placed under contract, except the end of the wall near Vallejo street.

At this point, it will be observed that there is a right angle in the course of the sea wall. The end of the wall will be a continuation of the back of the wall of the adjoining section, which is parallel to Vallejo street.

The dredged channel must be continued to the full width and depth sixteen feet from the end of the wall, and the stone and earth embankment filled in to the center line of the water front on both Front and Vallejo streets. The culverts on the sections advertised will all be three feet in width and five feet high in the clear.

The cost of constructing the brick culverts through the masonry must be included in the contract price for the masonry, and of the

framed culverts through the earth embankment, in the contract price for embankment. When bids are made for the entire work per foot lineal, the absolute amount to be paid on the contract will be the price per lineal foot multiplied by the number of feet in length of the wall of masonry, which corresponds for the several sections with the lengths stated in the advertisement. This amount must be considered to include full compensation for the dredging and embankment required beyond the *termini* of the wall, as described in the preceding specifications, and of all work and materials required for the completion and security of the work proposed to be constructed.

The plans and drawings herein referred to may be seen at the office of Wm. J. Lewis, Engineer, No. 302 Montgomery street, Room 5, fourth story, directly over the office of the Harbor Commissioners.

R. C. Franks





